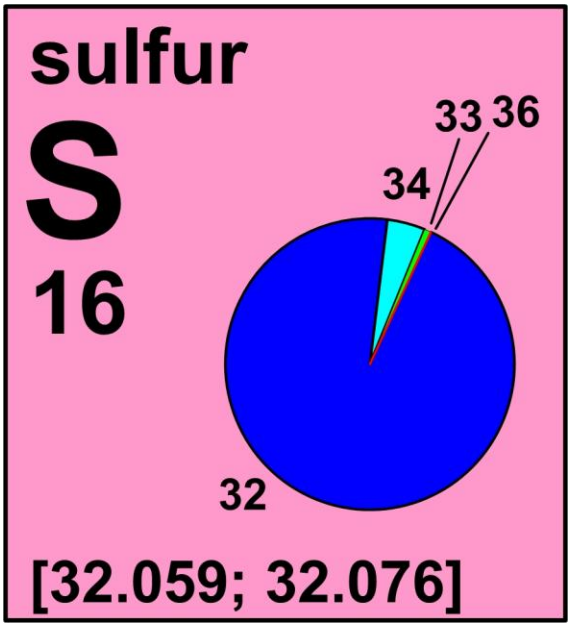
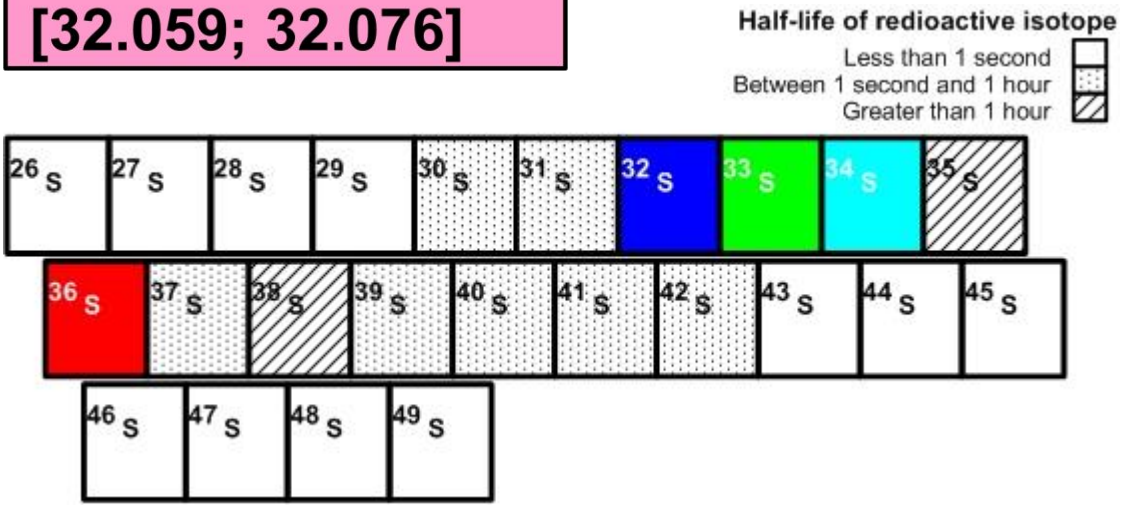
sulfur



Stable isotope	Atomic mass*	Mole fraction
^{32}S	31.972 071	0.9499
^{33}S	32.971 458 76	0.0075
^{34}S	33.967 8669	0.0425
^{36}S	35.967 080 76	0.0001

* Atomic mass given in unified atomic mass units, u.



Important applications of stable and/or radioactive isotopes

Isotopes in tracer studies

1) ^{35}S is the only radioisotope that has a half life of 87 days, which allows it to be used as a conservative tracer. ^{35}S is used to detect the absence or presence of sulfate in a body of water. If there is sulfate in the water, then that means part of the water is made up of recent (~1yr) precipitation.

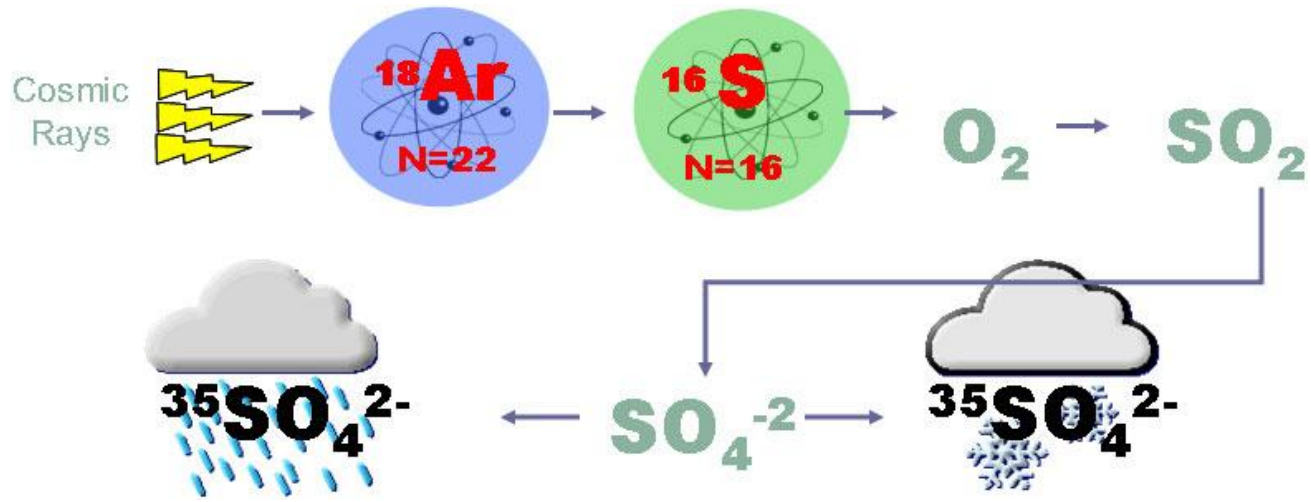


Figure 1: This diagram shows how ^{35}S is made when cosmic rays pass through argon clouds in the atmosphere and then precipitates as sulfate.

2) ^{34}S is used to distinguish between animal tissues developed in freshwater and marine ecosystems. Trophic fractionation of ^{34}S does not alter the interpretation of the data collected since the levels of ^{34}S are very different between the two environments. For example, by analyzing the level of ^{34}S in duck feathers, the environment in which the bird was living when these feathers developed can be determined. This helps to determine where these birds are from and where they go in the winter.
3) ^{35}S is used in direct labeling of elemental S or sulfate sources to trace the fate of S in fertilizers.
4) ^{35}S direct labeling of plant material is used to trace the fate of S added to plant residues.

Isotopes in food authentication

1) ^{34}S can be used as a tracer to authenticate meat from cattle. First, stable isotopes are used to infer the dietary source of the cattle. Once the source of the diet is found, ^{34}S can then be traced in certain muscle groups of the cattle and can be used to see if the diet of the animal has been changed or if the feed is consistent with what the animal is claimed to be fed.

Isotopes in hydrology

1) ^{34}S can be used to trace natural and anthropogenic sources of sulfur. It is mainly used to study acid mine drainage, the cycling of sulfur in agricultural watersheds, groundwater contamination by landfill leachate plumes, and the sources of salinity in coastal aquifers.